A Multi-disciplinary Tool for Space Launch Systems Propulsion Analysis, Phase I

Completed Technology Project (2012 - 2013)

Project Introduction

An accurate predictive capability of coupled fluid-structure interaction in propulsion system is crucial in the development of NASA's new Space Launch System (SLS). This STTR effort will develop a multi-disciplinary tool to improve CFD prediction capability in modeling coupled fluid structure interaction (FSI) phenomena for many SLS propulsion applications such as flexible inhibitors for SRMs. During Phase I, an Application Programming Interface (API) framework with conservative interface treatment will be developed to couple a NASA production CFD solver with a DoD open source nonlinear large deformation Finite Element solver developed by the proposing firm. The multi-disciplinary tool will be rigorously validated against coupled as well as decoupled problems (fluid and structure individually). Phase I will demonstrate the improved pressure oscillation modeling fidelity and provide great insight into the physics of nonlinear FSI leading to thrust oscillations in SRMs. The Phase II effort will conduct more validations and investigations of several SLS FSI phenomena including the physics of flexible inhibitors in triggering unsteady pressure oscillations and flow induced vibration of turbine and inducer blades in liquid rocket engines.

Primary U.S. Work Locations and Key Partners

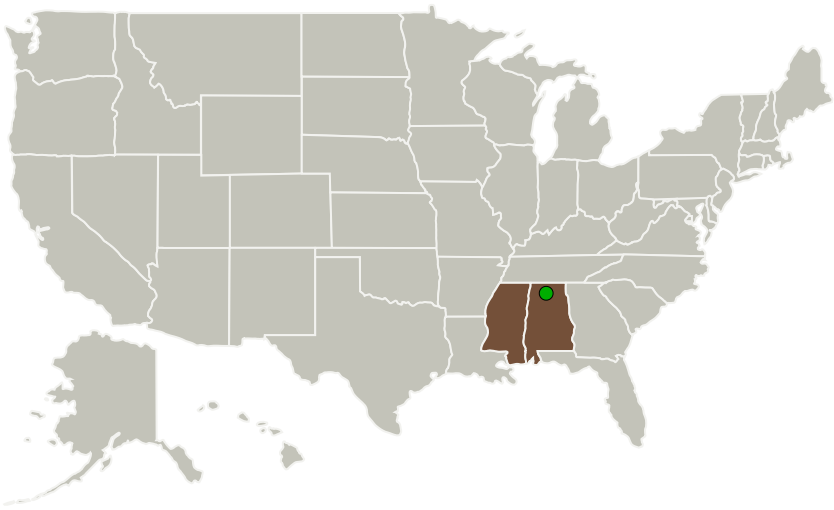

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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
CFD Research Corporation	Lead Organization	Industry	Huntsville, Alabama
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Mississippi

Project Transitions

February 2012: Project Start

February 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137833)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CFD Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

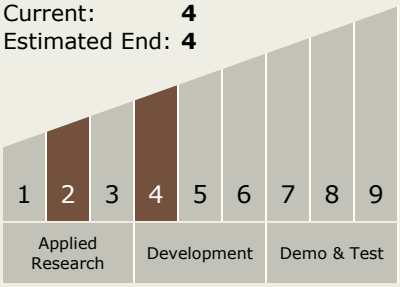
Carlos Torrez

Principal Investigator:

Robert E Harris

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.5 Structural Dynamics
    - TX12.5.1 Loads and Vibration

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System